

deductions, in spite of his mistake about the temporary continuity of the mandibular and hyoid arches, appears to me to be absolutely incontrovertible.

As far as I have seen, there is no other type in which the hyoid "cornu" is chondrified continuously with Meckel's cartilage, or the endoskeletal lower jaw.

This may be an acquired peculiarity, but I rather incline to the view that it is an old *hereditary* characteristic,

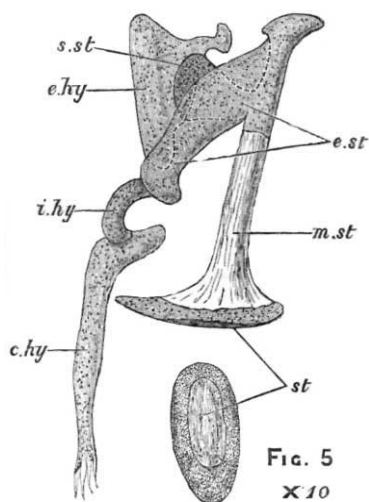


FIG. 5.—Same species as last (same stage, more advanced, 5 inches long), outer view. Lettering the same; the internal face of the stapes, *st*, is shown.

derived from a very remote ancestry, in which the visceral arches formed a basketwork of cartilage, and not a series of properly segmented arches, such as we are familiar with in most fishes. In *some fishes*, the "marsipobranchii"—Hag and Lamprey—we still see this lower, non-differentiated state of things.

There is a small distal part to the lingual or hyoid arch, but the lower part of the "cornu" (cerato-hyal) is

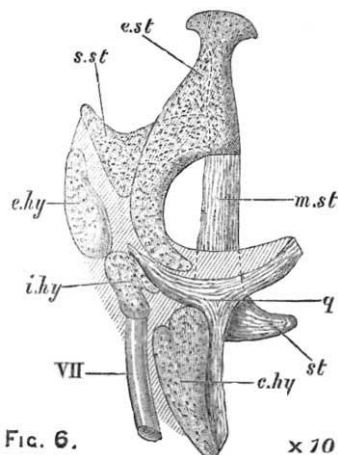


FIG. 6.—Same species as last (seventh stage, ripe embryo, 10 inches long), outer view. Lettering the same, with addition of *q*, quadrate bone; VII., facial nerve.

aborted by the continuity of its upper half with the lower jaw.

The rest of the arch resembles the branchial arch of a fish, and is like the proper hyoid arch of a *Chimæra*; the segments correspond very closely, but there is one piece too many, but this intercalary piece—the "inter-hyal"—is found in ganoid and osseous fishes—uniting their hyomandibular with their epihyal.

This fish-like hyoid soon becomes a continuous bar, as in the New Zealand Lizard (*Hatteria*), where the auditory columella and the hyoid arch are one continuous structure.

That condition, however, in the Crocodile, is only continued through the middle part of the term of incubation; towards the latter part of the time the parts that were fused all come to pieces again, and the ripe young has a free columella, with small, distinct nuclei of cartilage attached to the hinder margin of the ear-drum, these are *remnants* of the *epi*-, *inter*-, and *cerato-hyals*—the latter become free from the lower jaw during the middle of the incubating period.

The complex triple Eustachian tubes are formed after the middle of incubation, but before that time the basis cranii had become hollowed out, and so also had the quadrate and the articular end of the mandible.

By the time of hatching there are in the complex tympanic labyrinth or diverticula of the 1st *visceral* cleft, the following parts, namely:—

- a. The drum-cavity hollowed out of the quadrate.
- b. The middle, single, and the lateral, forked Eustachian tubes.
- c. The extension of the tympanic cavity into the whole posterior sphenoid, base and wings, into the periotic bones, and into the whole circle of the occipital arch or ring.
- d. Through the "siphonium," into the articular region of the lower jaw.

The investing bones are solid; only the ossifications of the primary chondrocranium are pneumatic; this hollowing out begins to take place before ossification sets in.

The pneumaticity of the Crocodile's endocranium is similar to what obtains in birds, the whole tympanic labyrinth in the two types is singularly like, and singularly unlike.

Note.—For descriptions of these parts in the bird-class I must refer the reader to my papers in the Royal, Linnean, and Zoological Societies. A full account of the development of the skull of the Crocodilia will soon appear in the *Transactions* of the latter society.

W. K. PARKER

#### PROF. HAECKEL IN CEYLON AND INDIA I.

PROF. ERNST HAECKEL of Jena, as most of the readers of *NATURE* are doubtless aware, has lately returned to his University after a six months' journey in India and Ceylon, undertaken in the interests of science with the object of providing additional data in support of the theory of evolution, of which he is the most able and best-known exponent in Germany. The veneration which he constantly expresses for Mr. Darwin, of whom he may be said to have been the first and perhaps the chief disciple on the Continent, would of itself suffice to give his opinions and observations weight in this country. No one, however, who has read the series of letters now being contributed by Prof. Haeckel to the *Deutsche Rundschau*, can fail to find them on their own merits both delightful and instructive. They are written in a popular form, but contain traces of profound scientific knowledge combined with great quickness and freshness of observation, and an almost boyish exuberance of delight in the presence of nature's wonders. Of the three letters or articles already published, the first contains an account of the voyage to India, the second, entitled "A Week in Bombay," describes with vivid enthusiasm the caves of Elephanta and the other marvels of that most interesting of tropical cities, and the third, contained in the June number of the *Rundschau*, of which we propose to give a short reproduction for the benefit of our English readers, brings the Professor to the "promised land" of his scientific yearnings—that island of Ceylon which exhibits in all its varied

charms "the highest conceivable development of Indian nature."

It was on November 21, 1881, that the Austrian Lloyd steamer *Helios*, bearing Prof. Haeckel and his numerous chests, some containing scientific instruments, others empty for the reception of specimens, came to an anchor in the harbour of Colombo. He describes in a few graphic words the vision of beauty which met his eager gaze as the morning twilight cleared away, and the island, with its fringe of delicate palm forests, and more thickly wooded interior highlands, crowned in the centre by the mysterious summit of Adam's Peak, expanded before him in all the blaze of tropical sunshine. Directly in front lay the fort and harbour, to the right (or south) the beautiful suburb of Colpetty, in which the majority of the Europeans have their residence, and to the left (or north), the Pettah or "Black town," inhabited by the native races. Prof. Haeckel was warmly received on landing by his countryman, Herr Stippenberger, the agent of the Austrian Lloyd, in whose bungalow, on the northern side of the town, at a considerable distance from the fort, and still farther from Colpetty, he passed the two first weeks of his stay in Colombo, which he describes as among the most delightful of his life. His first drive in Ceylon, from the Fort to Whist Bungalow, through the Pettah, opened out before him, as he himself says, a quick succession of scenes of Eastern beauty. The brown clay huts of the natives, each with its garden of cocoa-nut palms and plantains; the motley population of red-brown Singhalese, and darker Tamils, grouped round the doors, carrying on all their domestic concerns in the open air, combined with the bright red tint of the soil to produce bewildering contrasts of form and colour, together with a charming impression of primitive simplicity, and harmony with surrounding nature. It would be impossible to make even a passing mention of the Singhalese and their domestic life without digressing into a description of their most valued and often their only possession, the cocoa nut palm of whose substance every part is turned by them into account.

"The number of cocoa palms on the island," says Prof. Haeckel, "is calculated at 40,000,000, each palm yielding from 80 to 100 nuts (8-10 quarts of oil). It is not found in the northern half of the island, nor on a great part of the eastern coast. Its place is here supplied by the not less useful palmyra palm (*Borassus flabelliformis*). This is the same which covers the hot and dry districts of Hindostan, growing in great profusion near Bombay. Even from a distance the two palms vary greatly. The palmyra is a fan-palm, with a strong, very straight black stem, topped by a thick bunch of fan-shaped leaves. The cocoa, on the other hand, is a feather-palm, its slender white stem, 60 to 80 feet high, is gracefully curved, and adorned with a bushy crown of feathery leaves. The lovely Areca palm (*Areca catechu*) has similar, but stiffer and smaller leaves, and a tapering reed-like stem; it is an invariable feature of a Singhalese garden, carefully tended for the sake of the nut, which, being chewed together with the leaf of the betel pepper, colours the teeth and saliva red. Another palm, the Kitool (*Caryota urens*) is cultivated chiefly on account of its abundant sugar-sap, from which palm-sugar (*Djaggeri*) and palm wine (*Toddy*) are prepared. Its stiff strong stem supports a crown of double-feathered leaves resembling those of the maiden-hair fern (*Adiantum capillus Veneris*)."

"After the palms the most important trees in the little gardens of the Singhalese are the bread-fruit and the mango. Of the former there are two kinds, the ordinary bread-fruit (*Artocarpus incisa*), and the Jak tree (*Artocarpus integrifolia*), growing everywhere in great pro-

fusion. Another tree frequently cultivated by the natives is the curious cotton tree (*Bombax*). Mingled with these round the Singhalese huts is the beautiful banana or pisang tree, well deserving the name of "fig of Paradise" (*Musa sapientum*). Its beautiful yellow fruit, affording excellent nourishment either raw or cooked, is here seen in numerous varieties. Magnificent clusters of its gigantic light green leaves topping a slender stem from 20 to 30 feet high overhang the Singhalese huts, and form their loveliest adornment. Scarcely less effective are the arrowy leaves of the Aroideæ, especially of the Caladium, cultivated for its esculent roots, the same being the case with the Manihot, with its lovely clusters of hand-shaped leaves (belonging to the Euphorbiaceæ)."

Prof. Haeckel next proceeds to give a short statistical account of the population of Ceylon. In Colombo itself, as well as in the whole southern and western crests of the island (with the exception of the north-west) the large majority of the population consists of Singhalese proper, or descendants of the Indian Hindoos who overran Ceylon in the sixth century B.C., but in the northern half of the island, and on the east coast, as well as in large tracts of the central highlands, the Singhalese have been driven out by the Malabars or Tamils from the southern parts of the Indian peninsula, more especially from the Malabar coast. At present the Tamils comprise about a third of the whole population of Ceylon, and their number is yearly increasing; they are stronger and harder than the Singhalese, and all the heavier labour falls to their share, the Singhalese only occupying themselves in the lighter kinds of agricultural work. Besides these, there are the Indo-Arabians of Ceylon (called Moormen or Moors), descendants of the Arabs who gained a footing in the island more than two centuries ago. The residue of the native population is composed of the wild aborigines (Veddahs and Rodiyahs) of immigrant tribes from various parts of Asia and Africa, and of Malays, Javanese, Parsees, Afghans, Negroes, and Kaffirs; in all about 25,000. Europeans number altogether only three to four thousand, principally, of course, English and Scotch. The whole of this motley population at the present time may be calculated at 2,500,000, divided as follows:—

Singhalese (chiefly Buddhists) ... ..	1,500,000
Tamils (or Malabars, chiefly Hindoos) ... ..	820,000
Indo-Arabians (Moors, chiefly Mohamedans) ... ..	150,000
Mixed descendants of various races ... ..	10,000
Asiatics and Africans (Malays, Chinese, Kaffirs, Negroes, &c.) ... ..	8,000
Burghers (Portuguese and Dutch half-bloods) ... ..	6,000
Europeans (chiefly English) ... ..	4,000
Veddahs (aborigines) ... ..	2,000
Total ... ..	2,500,000

A considerable number of all the native races have been converted to Christianity.

Whist Bungalow, where, as we have already mentioned, Prof. Haeckel spent the earlier part of his stay in Ceylon, received its somewhat curious name from the passionate addiction to card-playing of a former possessor. It is situated on one of the most picturesque spots in the neighbourhood of Colombo—that which lies to the north of the fort on the angle between it and the mouth of the river Kalany. Some portions of the description of the site of the bungalow and of his friend's garden must be given in Prof. Haeckel's own words:—

"The airy verandah commands a magnificent view of the sea, of the mouth of the Kalany, and of a lovely little island covered with vegetation, which lies in its delta. Further north, the eye follows a long strip of cocoa wood extending along the coast to Negombo. To the south lies the garden of the Bungalow, and beyond it a picturesque plot of land scattered over with fishing huts, nestling under the shade of slender palms; in their midst a little Buddhist temple, and further on a rocky swamp

<sup>1</sup> Sir J. Emerson Tennent ("Ceylon," I., p. 127), mentions, as curiously illustrative of the minute subdivision of property in Ceylon, a case which was decided in the district court of Galle, the subject in dispute being a claim to the 2520th part of ten cocoa nut trees!



covered with screw pine (*Pandanus*), &c. From this swamp springs a narrow sandy neck of land extending northward to the river's mouth, and so lying as to inclose a peaceful little lake in front of our garden. A few fishing huts are erected on this tongue of land, and from morning to night it presents a constant succession of animated and amusing pictures. Here in the early morning, before sunrise, the inhabitants of the huts assemble to take their morning bath in the river. Then the horses and oxen have their turn, and are brought down to water. Busy washers are at their work all day, beating the clothes with flat stones, and spreading them on the shore to dry. Fishing boats go up and down continually; and in the evening, when they have been drawn up to land, and the great square sails have been spread to dry, the lagoon, with its long row of motionless sails, looks wonderfully picturesque, especially when the evening breeze swells the sails, and the sun, sinking into the sea, floods the whole shore with a radiance of gold, orange, and purple. . . . The garden of Whist Bungalow has been converted, by the care and taste of its proprietor, into a veritable earthly paradise, containing examples of almost every native plant of importance, and thus forming a valuable botanical collection, as well as a fragrant and delightful pleasure garden. On the very first morning of my stay, as I wandered in rapturous delight under the shade of palms and fig trees, bananas and acacias, I gained a very comprehensive idea of the flora of the plains. Here the noble palm, in all its variety of foliage and fruit, rears its stately columns; cocoa and talipat, areca and borassus, caryota and palmyra; here the banana spreads its great feathery leaves to the wind, and displays its clusters of precious golden fruit. As well as various kinds of the common banana (*Musa sapientum*), a fine example of the Traveller's tree of Madagascar may here be seen (*Urania speciosa*). It stands just at the division of the principal walk, from which the path to the right leads to the bungalow, and that to the left brings us to a magnificent specimen of the banyan or sacred fig tree (*Ficus bengalensis*), forming, with its hanging air-roots and numerous stems, a very striking object; beautiful Gothic arches open out among the roots which, pillar-wise, support the main structure of the tree. Other trees of various groups (terminalia, laurels, myrtles, iron-wood trees, bread-fruit, &c.) are over-grown and intertwined with those lovely creeping and climbing plants which play so important a part in the flora of Ceylon. These belong to the most varied families, for in the dense forests of this magic island, and under the favourable influences of moisture and warmth, a countless multitude of climbing plants strive and cling, and grasp their way upward to the light and air.

"Among the charms of this most lovely garden must be included the large-leaved Calla plants or Aroideæ, and the graceful feathery ferns, two groups of plants, which, both by their individual mass and by the beauty and size of their development, occupy an important place in the lower flora of Ceylon. Scattered among them are many of the finest shrubs and flowering plants of the tropics, partly indigenous, partly introduced from other tropical regions, especially from South America, but all perfectly at home here. Among these rises the stately Hibiscus, with great yellow or red flowers, the flame tree or acacia, a mass of splendid flame-coloured clusters (*Casalpinia*); venerable tamarinds with their aromatic blossoms; while from every branch hang clinging convolvuli with gigantic bell-shaped flowers, and aristolochias, yellow and brown. Rubiaceous plants, such as lilies, orchids, &c., bear extraordinarily large and beautiful blossoms. . . . The animal life inhabiting this garden of Eden does not altogether correspond in variety and abundance with its vegetable world; this is especially the case with its larger and more striking forms. In this respect, as far as I have been able to ascertain, the island is inferior to the

Indian mainland and to Sunda Island, and still more so to tropical Africa and Brazil. I must confess that my first impression was one of disappointment, which rather increased than diminished as I came to know the fauna more intimately, even in the wilder parts of the island. I had expected to find the trees and bushes thronged with apes and parrots, and the flowering plants with butterflies and winged insects of curious form and brilliant hue. But my expectations were doomed to remain unfulfilled, and my only consolation was that other zoologists visiting the island had been equally disappointed. Nevertheless, careful search reveals much that is curious and interesting, even to the zoologist, and in its main features the fauna of Ceylon, though not so rich and brilliant, is quite as singular and characteristic as its flora.

"The vertebrate animals which first claimed my attention in Whist Bungalow and the immediate neighbourhood of Colombo, were numerous reptiles of brilliant colours and curious forms, especially snakes and grasshoppers, and pretty little tree frogs (*Ixalus*), whose weird, bell-like note, resounded in the evenings. The birds chiefly visiting the gardens are starlings and crows, water-wagtails and bee-catchers, and above all the pretty little honey-sucker (*Nectarinia*), which here takes the place of the humming-bird; kingfishers and herons abound on the river banks. Among mammalia the most frequently occurring is the pretty little squirrel that leaps about among the trees and shrubs, and is very tame and confiding; its colour is a brown grey, with three white stripes lengthwise down its back (*Sciurus tristriatus*). Among the insects, dense swarms of which abound everywhere, the first to be named are ants (from the minutest to the most gigantic sizes) including the destructive termites or white ant; wasps and bees among the hymenoptera, and gnats and flies among the diptera are also very abundant. The larger and finer forms of insect life, such as chafers, butterflies, &c., do not exist in any proportion to the flora of the island. Orthoptera (grasshoppers, crickets, &c.), on the other hand, are very varied and curious in form. I will content myself at present with this cursory mention of a subject to which I hope later to return.

"Of articulate animals the spiders (*Arachnidæ*) form a very interesting and curious class, from the minutest mites and ticks upwards to the bird-spinners and scorpions. The closely-allied Millipeds or Myriapodæ are very numerous and of colossal size, sometimes as much as a foot long. I saw one famous specimen on my first morning in the garden of Whist Bungalow, but I was too lost in admiration of the glories of the vegetable kingdom round me to have time for a nearer examination of the animal world."

In this first intoxication of delight which accompanies the realisation of a life-long dream, we must for the present leave Prof. Haeckel, hoping in a future number to give some further account of his observations on the fauna and flora of Ceylon.

#### NOTES

WE hear that Princeton College, New Jersey, is going to despatch a second scientific expedition this summer to the "bad lands" of Dakotah and Nebraska in search of fossils. It will be under the charge of Mr. W. B. Scott, of the "E. M." Geological Museum of Princeton, who is known to many readers of NATURE on this side of the Atlantic by his papers on the development of *Petromyzon*, &c. A former expedition of a similar kind, undertaken in 1877 under the same auspices, and composed of Messrs. Scott, H. F. Osborn, and F. Speir, jun., succeeded in making a valuable collection of vertebrate remains, which have been fully described in the "Palæontological Report of the Princeton Scientific Expedition of 1877" (Princeton, 1878), and now adorn the geological museum there.